

proponents. The letter contained two attachments, one entitled "LMS Consensus Position on Part 15 Interference" dated June 22, 1994 ("Consensus Position Paper"), and the second by G.K. Smith entitled "Further Analysis of Interference of Part 15 Devices and LMS Wideband Systems" also dated June 22, 1994 (Issue 1.4).

5. The June 23 letter and its two attachments address some aspects of the potential for intersystem interference from low power emission devices operating in accordance with Part 15 rules within the 902-928 MHz band to relatively high power operations by the wideband mobile-to-base portions of LMS systems. LMS systems use base stations at multiple sites to communicate with mobile transceivers to determine the locations of the mobiles. Both the LMS base stations and LMS mobiles transmit in the 902-928 MHz band.

6. The LMS letter and its two attachments focus solely on concerns with respect to Part 15 device interference to wideband, i.e., uplink, portions of LMS systems. These documents fail to address in any way the concerns of Part 15 users with respect to interference by the relatively high powered LMS transmitters to operations by Part 15 devices. For example, gas and electric utilities employ Automatic Meter Reader ("AMR") Part 15 devices that transmit energy consumption and tamper information from meters to mobile receivers using low power transmissions in the 910-920 MHz band.

7. The simultaneous operations in the same 902-928 MHz band of diverse wide-area communications systems, with most systems using numerous very low powered devices (e.g., 10 milliwatts), while one or two systems sharing the spectrum

use much higher powered transmitters (e.g., 10 to 500 Watts), is a technically flawed concept. In accordance with good engineering practice, the high powered systems should be assigned spectrum separate from that shared by the diverse low powered devices.

8. Proper evaluation of the Consensus Position Paper is difficult because of a lack of any technical compilation and analysis of the data presented. Standards of -101 dBm and -91 dBm are proposed as minimum signal levels at LMS base station receiver sites as representing "interference" from a Part 15 user. The -91 dBm level would apply only to Part 15 devices that transmit less than 10 percent of the time. A collection of hard-to-discern figures showing receive signal level samples of interference at LMS sites, are included in the Consensus Position Paper. Times and dates are not indicated on most of the figures. These samples appear to include several instances of interfering signals above the -101 dBm and -91 dBm levels, apparently contradicting the statements contained in the recent LMS submission of only a few instances of interference to LMS systems experienced to date. While the figures are not clear and are difficult to read, there appear to be more than 10 instances of interfering signals above -101 dBm.

9. The Consensus Position Paper submitted by the LMS proponents suffers from omissions of critical information and appears to contain poorly supported conclusions. The conclusions of the Consensus Position Paper are supported by very limited data and analysis and instead rely upon selected and limited presentations of anecdotal information. The basis of assumptions or data taken as fact is not clearly

stated nor susceptible of independent verification. To understand the data depicted in the 20 figures of the Consensus Position Paper one would need more information concerning these specific LMS systems and sites, the nature of the interfering signals, whether simultaneous interference from multiple Part 15 devices was present, etc. None of that information, essential to determining the validity of the information set forth in the paper, is included.

10. Moreover, the evidence presented is anecdotal and could be unrepresentative. There are millions of Part 15 devices now in operation. Millions more are scheduled to be placed in service. Yet, the LMS proponents have chosen to rely on their experience in operating developing or experimental systems in only a few locations for a relatively short period of time. That appears to be insufficient practical experience on which to extrapolate a conclusion that future interference is unlikely. In addition, the Consensus Position Paper is bereft of details of case studies concerning those interference issues which it reports to have arisen. Details such as distances between the Part 15 devices and the LMS facilities in question, and respective power levels and other data would be needed for a proper evaluation of the material presented.

11. According to the Consensus Position Paper, LMS systems, although operating in only nine markets, have experienced 55 cases of harmful interference. In its Further Reply Comments filed at the FCC on March 29, 1994, on page 18, MobilVision, an LMS operator, stated that: "These [Part 15] devices, however, vary significantly in power usage and operating conditions: many are used in applications

that will neither cause nor be affected by interference in relation to the operation of LMS systems; others will undoubtedly not be able to coexist on the same frequencies with such [LMS] systems."

12. Rather than rendering a decision from anecdotal evidence which does not represent the future architecture of this band, it appears that it would be prudent for the Commission to make its evaluation and decisions only after receipt of hard data in the form of the results from controlled testing and experimentation. Notes concerning possible Part 15-Teletrac interference tests were attached to a November 24, 1993 letter from the Chairman of the Telecommunications Industries Association ("TIA"), Mobile and Personal Communications, Consumer Radio Section, Dr. Jay E. Padgett, to the Teletrac Vice President for Corporate Development, Cynthia S. Czermer. A copy of this letter has been provided to the FCC's Chief of the Private Radio Bureau as well as the FCC's Chief Engineer.

13. At least one LMS system has completed field testing to examine the electromagnetic compatibility of its LMS system with that of a tag reader system operating in the same market. See the letter submitted to the Commission on behalf of Pinpoint Communications on January 24, 1994. Testing for LMS-tag reader compatibility for shared use of the 902-928 MHz band appears appropriate. Careful testing, possibly by the FCC's own labs, prior to attempting to formulate rules and procedures for shared spectrum use by LMS and Part 15 users would be equally appropriate.

14. The LMS Consensus Position Paper asserts that all cases of interference encountered so far by LMS systems were easily resolved by the LMS operator and Part 15 users without any "user of a Part 15 device ever been required to cease operation." However, according to the paper: "In almost all cases, the interference has been resolved by changing the operating frequency of the Part 15 device with the LMS company paying the cost." In the case of the AMR equipment used by the Gas Utilities, these devices are sealed and not susceptible to retuning. Moreover, the unqualified interference-will-be-no-problem assertion of the Consensus Position Paper is not consistent with the experience of the Southern California Gas Company. This company was prohibited as a result of objections by PacTel Teletrac from field testing an AMR data transmitting device close to a PacTel Teletrac LMS installation on the basis of potential interference.

15. This particular point regarding the potential dangers of relying on limited experience concerning intersystem interference in the 902-928 MHz band was made in a November 24, 1993 letter to PacTel Teletrac's Vice President for Corporate Development, Cynthia S. Czerner, from TIA's Chairman of its Mobile and Personal Communications, Consumer Radio Section, Dr. Jay E. Padgett. In this letter, Dr. Padgett wrote as follows:

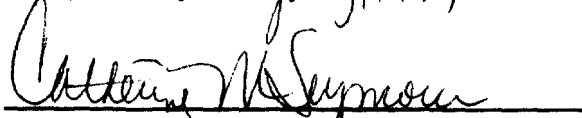
Finally, I would like to caution you regarding any inferences you might draw from your limited experience with part 15 interference to date. While the penetration of Part 15 devices may be relatively low now, it is increasing, and we expect that trend to accelerate as manufacturers complete their designs and deploy products. Hence, the past is not a reliable predictor of the future in this case.

16. The statement that LMS subscriber unit growth will not increase interference, see page 3 of the Consensus Position Paper at note 2, is misleading. LMS system operators plan to expand their subscriber numbers by expanding their geographic coverage, i.e., markets. As more and more markets are included, many more LMS base station sites will be activated and the number of interference cases will greatly increase. Moreover, the Consensus Position Paper statement only has validity in an existing built-out LMS market in cases of interference to LMS base station receivers by Part 15 devices. The statement is untrue with respect to the potential for LMS systems to interfere with the functioning of Part 15 devices, including the AMR equipment employed by the Gas Utilities, since increased distribution of mobile radiators in this band will represent an increasing source of interference to Part 15 devices.

17. The foregoing statements of fact are true and correct to the best of my own personal knowledge and belief, and are proffered in good faith.


THOMAS G. ADCOCK, P.E.

Subscribed to and sworn to before me
this 15th day of July, 1994


Notary Public

My commission expires:

My Commission Expires June 14, 1995

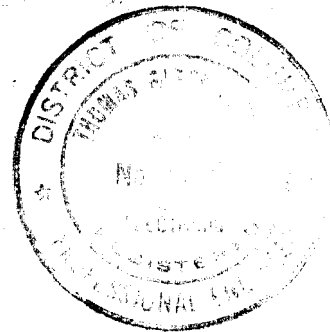


Exhibit II

AFFIDAVIT

City of Washington

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: SS

District of Columbia

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I, SOLYMAN ASHRAFI, having been first duly sworn, depose and state as follows:

1. I am the Director of Emerging Technologies for the firm of Lukas, McGowan, Nace and Gutierrez, Chartered.

2. I graduated from the Catholic University of America with a Bachelors degree in Electrical Engineering, a Masters degree in Communications Engineering, a second Masters degree in Acoustics (Wave Propagation), and Ph.D. degrees in Applied and Theoretical Physics with thesis on Radiation Theories.

3. For the past ten years I have been responsible for the development of propagation software for the wireless industry. This software is presently used by several major mobile communications carriers. Moreover, I have served as a consultant to telecommunications companies as well as an adjunct Professor of Engineering to a number of colleges and universities during the past ten years.

4. I have published more than 30 technical documents on mobile radio environment, eight professional journal publications on advanced signal analysis, six National Aeronautic Space Administration (NASA) documents on complex information theory subjects, five professional journal publications on electromagnetic waves in

different structures, and contributed to a text book on classical and quantum dynamics.

5. On behalf of an ad hoc coalition of natural gas distribution utilities ("Gas Utilities"), I have reviewed a copy of a June 23, 1994 letter to the FCC's Chief of the Private Radio Bureau, Ralph Haller, from four Location Monitoring System ("LMS") proponents. The letter contains two attachments, one entitled "LMS Consensus Position on Part 15 Interference" dated June 22, 1994, and the second, by G.K. Smith entitled "Further Analysis of Interference of Part 15 Devices and LMS Wideband Systems" also dated June 22, 1994 ("Smith Paper").

6. The June 23 letter and its two attachments address some aspects of the potential for intersystem interference from low power emission devices operating in accordance with Part 15 rules within the 902-928 MHz band to relatively high power operations by the mobile-to-base portions of LMS systems. LMS systems use base stations at multiple sites to communicate with mobile transceivers to determine the locations of the mobiles. Both the base stations and the mobiles transmit in the 902-928 MHz band.

7. A formula for the probability, P_b , that the wanted LMS signal is blocked is shown on page 5 of the Smith Paper. This equation is derived in the Annex A to the Smith Paper. The derivation begins with a Binomial distribution in Equation (5) on page 26, and this is expanded with an incorrect numerator in Equation (8) on page 27. The derivation continues with the assumption that Binomial distribution can be approximated by the Poisson distribution, with a footnote indicating that this is done

for easier calculations. This approximation cannot be made arbitrarily. The validity of the approximation requires certain conditions to be satisfied, which are not shown to apply in this case.

8. For example, using the same variables as used in Smith's Paper, this approximation would be valid only when N (the number of Part 15 devices in the unit area circle) approaches infinity and F_t (the average fraction of time that the Part 15 device is transmitting) approaches zero, such that NF_t remains constant.

However, neither of these conditions are applicable in the case at hand. In fact, on page 14 of the document, it is stated that "From Table 4 it is noted that for a NFR of 7.5 the number of Part 15 devices, N , is 45 for a probable loss of location." In statistical theory, a value of $N = 45$ cannot be considered infinity and one should not make such an assumption. For the second condition, F_t must approach zero to satisfy this transformation. If this is true, how can one evaluate the potential for interference? The answer is that a theoretical study is not realistic. Instead, measurement and testing are required.

9. The first equation on page 5 of the Smith Paper for P_r is the basis for all the rest of the analysis, so one cannot accept the analysis and conclusions unless the derivation of the equation is verified.

10. On page 6 of the Smith Paper there are a series of propagation assumptions made to calculate NFRs (the Near Far Ratios). It is stated that:

These values were 'worse case' in that the propagation of the unwanted signals did not include additional losses other than theoretical minimum.

11. The paper further gives some typical losses due to blocking, wall penetration and antenna directivity. These typical values do not appear to be correct. For example, 10 dB of loss per wall at 900 MHz is high for an average building.

12. Although claims have been made that these values are not used, referring to "Interference Analysis of Part 15 Devices and LMS Wideband Systems," March 8, 1994 by G.K. Smith," on page 10 it is clear that the assumptions are used for calculations.

13. On page 27 of the Smith Paper, Equation (10) is derived from Equation (9) without showing the intermediate steps, and the result is not correct (see Attachment 3 of this affidavit).

14. It is clear that simulations and analysis on paper with unjustified assumptions cannot resolve the issue of interference from Part 15 devices to LMS systems. Measurements of interference should be performed in accordance with an appropriate test plan.

15. The attached tables (Attachments 1 and 2) provide certain propagation calculations relevant to this issue. The first table is constructed using a frequency of 915 Mhz, a transmitter height of two meters, a transmitter power of 10 mW or 0.01 W a receiver height of 30 meters, and a received power threshold of -91 dBm or 7.94×10^{-13} W. Calculations of the path loss with isotropic antennas are made with different propagation models for comparison. The output of the calculations is the distance (in km and miles) required to reach -91 dBm.

The first model is the Free Space model, which is independent of height of the receiver and the transmitter. The path loss equation for Free Space depends only on frequency and distance between receiver and transmitter.

The second model is the Plane Earth model, which is independent of frequency. The path loss equation for the Plane Earth model only depends on the height of the receiver and the transmitter and the distance between them. The dependence of the Free Space path loss and Plane Earth path loss to distance are functionally different. In Free Space path loss, this dependence is $1/r^2$ where r is the distance between the receiver and the transmitter. In Plane Earth path loss, this dependence is $1/r^4$, which means that there is more loss compared to Free Space model and this is due to ground reflection. In this model, the dependence of power received to the height of the transmitter is $P_r \propto h_t^2$, (where P_r is the received power, h_t is the transmitter height and \propto is the proportional symbol.) This is experimentally verified in many experiments.

The Plane Earth model also suggests that the power received is proportional to the height of the receiver as $P_r \propto h_r^2$, (where h_r is the height of the receiver). Experimentally, this has been shown to be incorrect.

The third model is the Egli model, which calculates the distance using median path loss. This model is similar to the Plane Earth model with extra correction loss introduced. This correction in loss is frequency dependent, which can be considered as an improved version of the Plane Earth model, because the Plane Earth model is frequency independent.

The fourth model is the model used for FCC contours and the fifth model is the Hata model. Hata developed a path loss equation using Okumura's measurements in Tokyo and is divided to three environmental categories. This model takes terrain features into account. Okumura's measurements in downtown Tokyo may not represent the actual operating environment. Therefore, measurements are necessary for two reasons. First, the theoretical models over simplify the real world propagations, and second, the experimental models are based on measurements made in environments different than the ones we are interested, such as Tokyo.

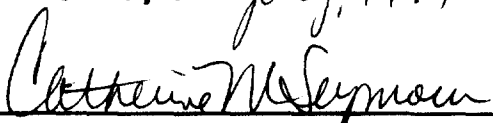
The second and the third tables in Attachment 2 are constructed using a frequency of 915 MHz with different antenna heights for -91 dBm and -101 dBm power receive thresholds. Distance required to reach these thresholds are calculated using different propagation models for comparisons.

16. The foregoing statements of fact are true and correct to the best of my own personal knowledge and belief.



SOLYMAN ASHRAFI

Subscribed to and sworn to before me
this 18th day of July, 1994



Notary Public

My commission expires: My Commission Expires June 14, 1995

$P_t = 10 \text{ mW}$
 Freq. = 915 MHz

$h_b = 6 \text{ ft.}$

$h_r = 100 \text{ ft.}$

Received Power Threshold = -91 dBm

	Distance (miles)	Distance (km)
Free Space Model	d = 1.815	d = 2.928
Plane Earth Model	d = 1.550	d = 2.501
Egli Model	d = 0.672	d = 1.084
FCC Model	d = 0.546	d = 0.883
Hata (u) Urban	d = 0.151	d = 0.243
(s) Suburban	d = 0.257	d = 0.415
(r) Rural	d = 0.531	d = 0.856

$$P_t = 500 \text{ W}$$

$$h_b = 30 \text{ m}$$

$$h_r = 6 \text{ ft.}$$

Received Power		
	-91 dBm	-101 dBm
Free Space Model	d = 405.934	d = 1,283.677
Plane Earth Model	d = 23.002	d = 40.904
Egli Model	d = 0.672	d = 0.672
FCC Model	d = 8.914	d = 8.914
Hata (u) Urban	d = 2.628	d = 5.052
(s) Suburban	d = 5.047	d = 9.704
(r) Rural	d = 12.272	d = 23.594
Sakagami	d = 0.895	d = 1.617

$$P_t = 10 \text{ W}$$

$$h_b = 2 \text{ m}$$

$$h_r = 6 \text{ ft.}$$

$$h_b = 15 \text{ m}$$

Received Power		
	-91 dBm ($h_b = 2\text{m}$)	-101 dBm ($h_b = 15\text{m}$)
Free Space Model	d = 57.408	d = 181.539
Plane Earth Model	d = 2.233	d = 10.877
Egli Model	d = 0.636	d = 0.662
FCC Model	d = 1.825	d = 3.622
Hata (u) Urban	d = 0.341	d = 1.221
(s) Suburban	d = 0.582	d = 2.265
(r) Rural	d = 1.207	d = 5.253
Sakagami	d = -	d = 0.312

Attachment 3

Starting with equation (9), page 27 of Smith Paper

$$P_b = 1 - \sum_{n=0}^N \left(1 - \frac{1}{2(NFR)^2} \right)^n \frac{(NF_t)^n}{n!} e^{-NF_t}$$

This can be written as

$$P_b = 1 - \sum_{n=0}^N \left(\left(1 - \frac{1}{2(NFR)^2} \right) (NF_t) \right)^n \frac{e^{-NF_t}}{n!}$$

That is

$$P_b = 1 - e^{-NF_t} \sum_{n=0}^N \frac{x^n}{n!} \quad \text{where} \quad x = \left(1 - \frac{1}{2(NFR)^2} \right) NF_t$$

Now if $N \rightarrow \infty$ to justify the approximation of the Binomial distribution by the Poisson distribution, then

$$P_b \approx 1 - e^{-NF_t} e^x \quad \text{where} \quad \sum_{n=0}^{\infty} \frac{x^n}{n!} = e^x$$

Thus

$$P_b \approx 1 - e^{x - NF_t} \approx 1 - e^{-\frac{NF_t}{2(NFR)^2}} \approx 1 - (e^{-y})^N \quad \text{where} \quad y = \frac{1}{2(NFR)^2}$$

F_t is assumed to be equal to 1.

This result is different than that of equation (10) on page 27 of Smith Paper. In fact one can make an incorrect approximation to get equation (10). Here is the procedure

$$e^{-y} \approx (1 - y) \quad \text{if } y \text{ is very very small, that is if } NFR \text{ is very very large.}$$

This assumption is not justified. But if you make this assumption anyway, one gets

$$P_b = 1 - (1 - y)^N = 1 - \left(1 - \frac{1}{2(NFR)^2} \right)^N \quad \text{this is precisely the equat. (10).}$$

Exhibit III

NOTICE OF ANNUAL MEETING

**PACIFIC  TELESIS
Group**

To the Shareowners of Pacific Telesis Group:

The 1994 Annual Meeting of Shareowners of Pacific Telesis Group will be held at the Masonic Auditorium, 1111 California Street, San Francisco, California, on Friday, April 29, 1994 at 10:00 a.m., for the following purposes:

1. To elect the four directors constituting Class I of the Corporation's Board of Directors to serve a three-year term.
2. To ratify the appointment of Coopers & Lybrand as the Corporation's independent auditors for the year 1994.
3. To approve the adoption of the Corporation's 1994 Stock Incentive Plan.
4. To act upon other matters that properly come before the meeting or any adjournment thereof, such as voting on the shareowner proposals which begin on page 15 of the proxy statement. (The directors oppose these proposals.)

Shareowners of record at the close of business on February 28, 1994 will be entitled to vote at the meeting or any adjournment of the meeting.

March 19, 1994

Richard W. Odgers
Secretary

JOINT VENTURES AND ACQUISITIONS

Cellular Communications, Inc.

On August 1, 1991, PacTel and CCI combined their cellular telephone interests in Ohio and Michigan by forming an equally owned joint venture ("New Par"). PacTel also purchased an initial ownership interest in CCI of approximately 5% for \$39 per share, or approximately \$90.0 million including related acquisition costs. During 1992, PacTel increased its holding in CCI to approximately 12% through open market purchases of stock. Both PacTel's joint venture interest in New Par and its purchase of CCI shares are accounted for under the equity method. The investment in net assets contributed by PacTel to the joint venture has been recorded at the same net book value reflected in PacTel's consolidated accounts prior to closing.

PacTel and CCI have entered into an agreement (the "Merger Agreement") under which CCI will, in October 1995, offer to redeem up to 10.04 million shares of its redeemable stock at \$60 per share (the "MRO"). PacTel is obligated to purchase from CCI at such price a number of newly issued shares of stock equal to the number of shares purchased by CCI in the MRO. At the same time, PacTel is obligated to purchase from CCI shares or stock options representing in the aggregate approximately 2.4 million shares at a price of \$60 per share, less the exercise price in the case of stock options. Pursuant to the Merger Agreement, PacTel acquired approximately 5% of CCI and obtained the right to acquire all of CCI's remaining equity in stages over the next several years.

Beginning in August 1996, PacTel has the right, by causing CCI to redeem all of its redeemable stock not held by PacTel (the "Redemption"), to acquire CCI, including its interests in New Par and such other CCI assets and related liabilities as PacTel and CCI may agree upon, at a price per share that reflects the appraised private market value of New Par (and such other CCI assets and related liabilities as PacTel and CCI agree shall be retained) determined in accordance with an appraisal process set forth in the Merger Agreement.

PacTel has the opportunity to evaluate up to three different appraisal values during the 18-month period beginning in August 1996, prior to determining whether to cause the Redemption. PacTel will finance the Redemption by providing to CCI any necessary funds.

In the event that PacTel does not exercise its right to cause the Redemption, CCI is obligated to promptly commence a process to sell itself (and, if directed by PacTel, PacTel's interest in New Par). In the event that PacTel does not direct CCI to sell its interest in New Par such partnership dissolves and the assets are returned to the contributing partner. CCI may, in the alternative, purchase PacTel's interest in CCI or CCI and New Par, as the case may be, at a price based upon their appraised values determined in accordance with the Merger Agreement. If CCI or its interest in New Par is sold within certain specified time periods not to exceed two years for a price less than the appraised private market value, PacTel is obligated to pay to each other CCI stockholder a specified percentage of such shortfall.

In connection with the CCI transaction, Pacific Telesis Group delivered a letter of responsibility in which it agreed, among other things, to continue to own a controlling interest in PacTel. Pacific Telesis Group and CCI have agreed to the termination of such letter of responsibility at the time that Pacific Telesis Group no longer has a controlling interest in PacTel in exchange for the provision by PacTel of substitute credit assurance, consisting of a \$600.0 million letter of credit and a pledge of up to 15% of CCI's shares on a fully diluted basis, for PacTel's obligations in connection with the MRO and for the payment of any make-whole obligation, respectively.

McCaw Cellular Communications, Inc.

In September 1993, PacTel and McCaw Cellular Communications, Inc. ("McCaw") contributed their respective cellular operations in San Francisco, San Jose, Dallas, Kansas City (Missouri/Kansas) and certain adjoining areas to a joint venture with equal ownership by each company. The new venture ("CMT Partners") manages two large cellular regional networks covering an estimated population of 9.2 million people. (PacTel previously had operations covering an estimated population of 4.5 million people in the joint venture service area.) In a related transaction, PacTel purchased McCaw's Wichita and Topeka systems for \$100.0 million.

PacTel Teletrac

PacTel Teletrac ("Teletrac"), a start-up company offering vehicle location services in six markets in the United States, is 51% owned by PacTel, and thus its operations are consolidated with PacTel. Effective March 31, 1992, Teletrac exercised its option to acquire all of the assets of International Teletrac Systems ("ITS"). The acquisition price was \$9.5 million to be paid over two years and the creation of a \$69.7 million "preferred capital account" for the benefit of ITS, which Teletrac accounts for as long-term debt. This amount was netted with a \$20.2 million receivable from ITS and was reflected as \$49.5 million long-term debt in the Consolidated Balance Sheet at December 31, 1992. This \$49.5 million debt has since been retired. Additionally, PacTel's 49% partner in Teletrac provided ITS with a 24% ownership interest in Teletrac, and, as a part of the purchase agreement, Teletrac credited ITS' capital account \$2.5 million.

Prior to the March 31, 1992 acquisition of ITS' assets, Teletrac had no ownership interest in ITS. However, PacTel had an obligation through Teletrac to ITS' lender, who had funded the substantial operating losses of ITS. Because of this obligation, Teletrac has consolidated ITS for all periods presented.

As of December 31, 1993, PacTel had advanced Teletrac \$170.5 million for ongoing operating expenses. Teletrac pays interest quarterly at Wells Fargo's prime rate plus 2%. Advances issued prior to May 29, 1992 have a three-year term with an option to extend for up to an additional five years. Advances issued after May 29, 1992 have a six-year term. PacTel can convert the advances into additional equity interests in Teletrac or Teletrac's corporate successor. The conversion rate may be based on an appraised price or a percentage of the price of stock issued in an initial public offering for Teletrac's corporate successor. Such initial public

offering, which may be solely elected by the shareholders of the minority partner of Teletrac, must generally occur prior to March 31, 1995.

Teletrac (including ITS) reported pre-tax losses of \$41.6 million, \$49.1 million, and \$36.8 million during 1993, 1992 and 1991, respectively. PacTel does not expect Teletrac's operations to be profitable for several years. PacTel intends to take actions to reduce Teletrac's operating losses and does not intend to expand Teletrac's operations significantly until its services achieve a higher level of commercial acceptance. In February 1994, PacTel reduced Teletrac's staff by 30% to approximately 200 employees. PacTel is continuously evaluating and considering other commercial applications of its technology and radio location spectrum.

NordicTel Holdings AB

In October 1993, PacTel acquired a 51% interest in NordicTel Holdings AB ("NordicTel"), one of three providers of global digital cellular services in Sweden, for \$153.0 million. PacTel also contributed \$5.4 million to NordicTel's equity capital. PacTel also holds an option exercisable between July 1 and September 30, 1994, to purchase an additional 6.75% of NordicTel's equity for approximately \$20.0 million.

Pro Forma Results

The unaudited pro forma data for significant acquisitions occurring in 1993 include the results of PacTel, Wichita and Topeka, and PacTel's share of the results of CMT Partners and NordicTel. The results listed below reflect purchase price accounting adjustments assuming the acquisitions occurred at the beginning of each year presented. The unaudited pro forma results are not necessarily indicative of what actually would have occurred if the acquisitions had been in effect for the entire periods and are not necessarily indicative of the results of future operations.

	<i>Year ended December 31,</i>	
<i>(Dollars in millions, except per share amounts)</i>	1993	1992
Net operating revenues	\$ 844.3	\$645.6
Income (loss) before extraordinary item and cumulative effects of accounting changes	\$ 15.4	\$(33.9)
Net income (loss)	\$ 9.8	\$(13.6)
Net income (loss) before extraordinary item and cumulative effects of accounting changes per share	\$ 0.04	\$(0.08)

COMMITMENTS AND CONTINGENCIES

Cellular Plus Inc.

A complaint has been filed in San Diego against PacTel's wholly owned subsidiary, PacTel Cellular ("Cellular"), and another regional telephone company (Cellular's competitor in San Diego), alleging on behalf of agents and dealers that Cellular engaged in price fixing of wholesale and retail cellular service.

The outcome of this action is uncertain. Accordingly, no accrual for a contingency has been made. PacTel intends to defend itself vigorously in this action and does not expect that any unfavorable outcome will have a material impact on its results of operations or financial condition.

Garabedian dba Western Mobile Telephone Company v. LASMSA Limited Partnership, et al.

A class action complaint has been filed naming as defendants, among others, Los Angeles Cellular Telephone Company ("LACTC") and PacTel, as general partner for Los Angeles SMSA Limited Partnership. The plaintiff alleges that LACTC and PacTel conspired to fix the price of wholesale and retail cellular service in the Los Angeles market. The plaintiff alleges damages for the class "in a sum in excess of \$100 million."

On January 31, 1994, PacTel filed a demurrer to the complaint. No discovery has been undertaken as of March 3, 1994. PacTel intends to defend itself vigorously. PacTel does not anticipate this proceeding will have a material adverse effect on PacTel's financial position.

Other

PacTel is party to various other legal proceedings in the ordinary course of business. Although the ultimate resolution of these proceedings cannot be ascertained, management does not believe they will have a materially adverse effect on the results of operations or financial condition of PacTel.

PacTel has no material long-term capital lease obligations. Rental expense for the years ended December 31, 1993, 1992, and 1991 was \$33.3 million, \$31.9 million, and \$26.6 million, respectively.

PacTel and the Pacific Telesis holding company have various letters of responsibility and letters of support for performance guarantees, refundable security deposits and credit facilities of certain subsidiaries and affiliates. These letters of responsibility and letters of support do not provide for recourse to either Pacific Telesis or to PacTel. Separately, as of December 31, 1993, PacTel guaranteed approximately \$10.4 million owed by a third party. PacTel believes that the likelihood of having to pay under the guarantee is remote.

A subsidiary of PacTel guarantees the liabilities of a third party, for which the subsidiary is indemnified by minority shareholders unaffiliated with PacTel. PacTel believes it is remote that it will be required to pay under this guarantee.

Additionally, in August 1993, PacTel provided a letter supporting the commercial paper program entered into by Telecel Comunicacoes Pessoais, S.A. in which PacTel may be liable for its proportionate share of the loans issued under the program if certain loan covenants are not met. As of December 31, 1993, the potential liability is approximately \$6.5 million. PacTel believes that the likelihood of having to pay under the letter is remote. (See also Note L - "Acquisition and Joint Venture Contingencies - Spin-off Operations" on page F-28.)

STOCK OPTIONS AND STOCK APPRECIATION RIGHTS

Compensation to Employees

Certain key PacTel employees are eligible for the grant of options to purchase shares of Pacific Telesis Group common stock and stock appreciation rights ("SARs") under the Pacific Telesis Group Stock Option and Stock Appreciation Rights Plan (the "Plan"). The Plan was adopted by Pacific Telesis Group on January 1, 1984.

Exhibit IV

THE WALL STREET JOURNAL.

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WHITE OAK, MARYLAND

Stray Signals

Clutter on Airwaves Can Block Workings Of Medical Electronics

Reports Trace Interference
To Cellular Phones, TV;
Safeguards Are Spotty

A Heart Monitor That Failed

By TOM KNUDSON
And WILLIAM M. BULKELEY

Staff Reporters of THE WALL STREET JOURNAL

As life-saving electronic medical equipment becomes more sophisticated and sensitive, evidence has begun to pile up that these instruments are vulnerable to increasing levels of electromagnetic interference — the waves given off by radios, cellular phones and television sets.

The consequences can be frightening: A ventilator malfunctions while the child using it is riding in a car, and the problem is traced to the car's cellular phone. A doctor installs a pacemaker after electrocardiogram equipment shows a patient's heart isn't working right; nurses later trace similar — inaccurate — readings on the machine to TV signals. A woman dies inside an ambulance as paramedics try to revive her heart with a defibrillator — which doesn't work because of interference from the vehicle's two-way radio.

Although electromagnetic interference, or EMI, has been known to be a source of problems for some time, the widespread use of cellular phones, metal detectors, computers and other sources of radio energy is creating pressure for stricter controls.

But only a few devices are subject to FDA review for electromagnetic vulnerability before they go on sale. "The problem is going to increase before it decreases . . . because of the proliferation of medical devices," predicts Joe Dyro, director of biomedical engineering at the State University of New York at Stony Brook. "There is still a lack of awareness of how to properly shield these devices."

EMI is a broad term for invisible waves and pulses, natural and man-made, that move through space and matter. Although the waves are usually harmless, certain devices will sometimes react to them, the way TV sets can pick up "snow" from a nearby hair dryer.

Zapped Wheelchairs

Government safeguards are spotty, but concern is growing at the Food and Drug Administration. Last month, the agency ordered makers of motorized wheelchairs to shield them from EMI and educate users about the hazard. The FDA said it acted after getting "many reports of erratic, unintentional powered-wheelchair movement." In one such incident, according to a recent article by an FDA researcher, radio waves zapped a power wheelchair, sending its passenger over a cliff in Colorado, "causing a broken hip and several other injuries." The victim wasn't identified.

The Phone Ban

A few hospitals are starting to act. Earlier this year, St. Margaret Mercy Healthcare Centers in Hammond and Dyer, two Indiana towns, banned cellular phones after linking them to medical-device failures. So did Children's Memorial Hospital in Chicago last November.

"We've verified potentially dangerous interference with ventilators, electrocardiogram monitors, apnea monitors, infusion pumps, blood warmers, infant incubators, with the list continually growing," says Terry Clemans, St. Margaret Mercy's director of technology management. Mr. Clemans says cellular phones were interfering with signals sent by portable heart

monitors carried by patients. Most large hospitals use such telemetry monitors to free patients from bedside machines.

Jeffrey Silberberg, an FDA electronics engineer, says the FDA has received reports of EMI being involved in more than 100 frightening and occasionally fatal failures of medical equipment going back to 1980. In the fall 1993 issue of the journal Compliance Engineering, he cited these cases and called for tighter regulation.

A Wall Street Journal request under the Freedom of Information Act resulted in the release of reports of the incidents, without the names of patients or sites. FDA regulations require companies to file the reports, although most manufacturers don't acknowledge product malfunctions in these cases.

A Fatal Case

Physio-Control Corp., an Eli Lilly Corp. unit in Redmond, Wash., reported that medical technicians taking a 93-year-old heart-attack victim to a hospital in 1991 attached her to one of the company's LifePak monitor/defibrillators to track and try to revive her failing heart. But they said the heart machine shut down every time the technicians turned on their radio transmitter. The woman died.

Michael Willingham, director of regulatory affairs for Physio-Control, says the radio waves were the source of the problem. He says company engineers discovered that the ambulance maker had replaced the metal roof of the vehicle with a fiberglass dome that didn't block radio waves well — then placed a powerful, long-range radio-transmission antenna atop it. Mr. Willingham says this is the only incident of its type involving LifePak.

In 1992, a doctor installed an apparently unnecessary pacemaker in a patient's chest after an electrocardiogram telemetry system made by SpaceLabs Inc., also of Redmond, displayed "long periods of flat line." That evening, the same phenom-

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Stray Signals: Electronic Medical Gear Is Vulnerable To Interference From Cellular Phones, Television

Continued From First Page

non recurred. Nurses discovered that the patient was next to a TV set when the flat line occurred. "Current labeling has warning about TV interference with telemetry signals," SpaceLabs reported to the FDA.

"We've had only two or three instances of problems" with EMI, says John Hall, vice president of quality assurance at SpaceLabs. "Another kind of diagnostic would normally be done" before implanting a pacemaker, he adds, but the company "can't tell people how to practice medicine."

Some medical-products firms say they have long been aware of EMI, and add that it is standard practice to design systems to avoid it. Larry Saper, chairman of Data-scope Corp., a Montvale, N.J., maker of surgical devices, says, "In developing any device, you might discover wires are too close to one another. You move the wires and the problem goes away." Technicians installing electronic machines routinely check for interference.

'Black Art'

"We're dealing with a black art. A lot of this stuff is unconfirmed," says Joel Nobel, president of the Emergency Care Research Institute, a nonprofit organization in Pennsylvania that investigates medical devices. "I'm not saying there aren't problems—there are. But we don't know how frequent [or] significant they are."

Nevertheless, the proliferation of cellular phones and the growing use of medical electronics outside hospitals increase the chances of stray transmissions affecting delicate medical monitors. "We have a real concern and it has been growing as equipment has become more susceptible because of the use of micro-electronic, low-voltage circuits," says Bruce Burlington, director of the FDA's Center for Devices and Radiological Health.

One big problem is the elusive nature of EMI. "It's very, very hard to identify these events after the fact," says Michael Argenti, vice president for technology management at the Emergency Care Research Institute. "The problem is you can almost never reproduce them."

But sometimes you can come close. In May 1992, alarms sounded on five vital life-support ventilators in an intensive-care unit at Arkansas Children's Hospital in Little Rock. When nurses rushed to the devices, which help patients breathe, they found nothing wrong. But then a sharp-eyed respiratory therapist spotted a hospital shuttle bus outside.

"We started to think — could it be the radio on board?" says Pat White, a technician at the hospital. "One of the maintenance men pulled his radio off his belt, and standing in the middle of the room, close to the ventilators, keyed it up — and the same thing happened again." Mr. White says his

reaction was "panic — because of the amount of radios and cellular phones that float around this hospital."

Manual Revisions

The manufacturer of the ventilators, Siemens AG of Germany, says an investigation by an outside party hired by the company showed that other forms of EMI may have caused the malfunctions. Tim O'Malley, Siemens's director of marketing for ventilators in the U.S., says, "It's difficult to fix a problem when you really don't know what you're dealing with." The incident prompted Siemens to change its instruction manuals to warn about the risks of using two-way radios and cellular phones near its ventilators.

In June 1993, a ventilator made by Aequitron Medical Inc. malfunctioned while the child using it was in a car, says Ron Cundiff, director of security for Children's Memorial Hospital in Chicago, where the child was a patient. Mr. Cundiff says the machine began acting erratically when the child's mother used the car's cellular phone. "The readings started changing. And it started beeping," he says. "When she hung up, everything went back to normal."

Robert Samec, vice president of quality assurance and regulatory affairs at Aequitron, says that in subsequent testing the Minneapolis company discovered that cellular phones within three feet of a ventilator may set off the alarm. He notes that "the failure mode isn't catastrophic [because] generally the device will alarm and continue to ventilate the patient." The company has added warnings about cellular phones to its instruction manuals.

Aequitron previously had problems with EMI involving apnea monitors, which sense breathing and heartbeats in babies and guard against Sudden Infant Death Syndrome. FDA tests on the monitor found "it was very sensitive to electromagnetic interference" and the movement of people nearby, says Mr. Silberberg. In one test, he says, "a simulated patient was not breathing, but the monitor showed it was." Congressional testimony has also cited the Aequitron monitors for alarm failures.

No Lost Suits

In 1990, Aequitron sent out kits to owners of the monitors to improve the shielding. Mr. Samec says the company discovered that two-way radios and other transmitters near the monitors could trigger inaccurate alarms. The problem is that sleep-starved parents may turn off monitors that give false alarms. Mr. Samec says Aequitron has been sued over its monitors in cases where infants have died. But he says Aequitron hasn't lost any such suits, and "it's my belief that it's never been established that a malfunction has been associated with a death."

Some devices — such as apnea monitors, ventilators, and power wheelchairs — are screened by the FDA for vulnerability to EMI before reaching the marketplace. But many others are not.

The European Union is moving aggressively. On Jan. 1, 1996, it plans to impose mandatory standards for all electronic devices, including medical equipment, to ensure that they are immune to low-level electromagnetic interference.

In the U.S., the FDA is handling more than 5,000 applications for new medical devices, and sometimes EMI gets short shrift. Medical-device "reviewers are swamped as it is," says Mr. Silberberg. "Manufacturers are concerned about how long it takes to get things cleared. So it's hard to get the reviewers' time to discuss the problems with them."

Scrambled Chips

The heart of the problem is the microprocessor — the silicon chip that processes and stores data and acts as a central dispatcher, telling machines what to do and when to do it. "The problem with a microprocessor is it operates on a string of pulses," says Warren Boxleitner, vice president for technology at Thermo Voltek Corp., of Waltham, Mass. "If you apply a random pulse, which is what happens with electromagnetic interference, that scrambles the microprocessor. And it can totally screw up what it's trying to do." Thermo Voltek is attempting to build a business protecting devices from interference.

The FDA says growing awareness of the problem will lead to more safeguards. The Cellular Telecommunications Industry Association, worried about bans on phones or beepers, proposes creating a center for testing microprocessors to make sure they are adequately shielded against radio-frequency emissions. The Association for the Advancement of Medical Instrumentation, an Arlington, Va., group that sets voluntary standards in the U.S., recently created a committee to address electromagnetic problems.

Those measures are sure to affect devices of the future. But as Mr. Burlington at the FDA points out, "what we do with devices currently in the market" will remain a problem.

Exhibit V

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PACTEL
TELETRAC

A Pacific Telesis Company

December 22, 1993

**Dr. Jay Padgett
AT&T Bell Labs
Room 4J-626
101 Crawfords Corner Road
Holmdel, NJ 07733-3030**

Dear Jay:

CZ asked me to respond to your letter dated November 24, regarding the continuation of the process to assess the potential interference between Part 15 units and the Teletrac system, as well as Part 15 units among themselves.

We are confident that our system can operate under reasonable conditions in a band shared with units operating under Part 15, reasonable being defined by the interference level that these devices can tolerate themselves. To test this assumption, the amount of interference created by Teletrac to Part 15 units, Part 15 units to Teletrac and part 15 units among themselves can be determined by means of a statistical simulation, once the data is available and the scenarios agreed upon.

To this day, PacTel Teletrac has been the only company providing data that can be used to implement such simulation. The location of our sites is also available. The models for RF propagation in the urban and suburban environments are well known and documented in literature. The missing inputs for the simulation are the data regarding devices operating under Part 15 in the 902-928 MHz band.

We have not yet received technical information regarding such Part 15 devices. Accurate information is mandatory if the simulation is to be valid and useful. Since you chair the TIA Mobile and Personal Communications Committee dealing with Part 15 cordless phones, I am confident that you can explain to your partners on the Committee the importance of information that will support assessment of the quality of the service their customers may expect. You may also have good contacts with other Part 15 manufacturers and, if this is so, could help the process by providing